Meridian 1

Intelligent peripheral equipment circuit cards for Belgium

Option 11—Description and installation

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About this document

This document is a Supplement to the Option 11 *Installation guide* 553-3011-210. It describes the functions and applications of the following circuit cards that are available for use in Belgium:

- NT5K83HA E&M Tie Trunk card
- NT5K96HA Flexible Analog Line card

The above cards were introduced as part of the Phase 7C software program.

- NT5K82HA Central Office Trunk card
- NT5K84HA Direct Inward Dial trunk card

The above cards were introduced as part of the Phase 8B software program.

Central Office trunk circuit cards

Functional description

The NT5K82HA Central Office trunk card provides the interface between the Option 11 system and up to eight analog Central Office (CO) trunks. They can be installed in slot 1 to 10 in the main cabinet, as well as any slot in the expansion cabinet.

The NT5K82HA card has an on-board 16 KHz PPM pulse detector.

Common features

The NT5K82HA Central Office trunk cards:

- provides conversion for 8 audio paths
- provides software selectable A/μ Law operation
- provides indication of board status with faceplate mounted LED
- provides for disabling of individual units or the entire board under software or XPEC control
- provides loopback of Pulse Code Modulation (PCM) signals to DS30X for testing and diagnostic purposes
- indicates self-test status with faceplate LED
- provides termination impedance to match Belgian complex impedance Z1
- provides transhybrid Balance matching against Belgian complex impedance Z1
- provides for loss pads (analog-to-digital and digital-to-analog) as per the Belgian loss plan and call path set-up
- meets the Belgian Loss Plan and provide a base for future loss plan change by use of the B34 Codec with software selectable loss pads (phase 8B software)
- corrects signaling impedances to operate with the Belgian Central Office
- supports loop start signaling

Physical description

Switch settings

There are no option switches on the NT5K82HA Central Office trunk card. All settings are configured in software.

Connections

The NT5K82HA Central Office trunk card has eight units. Each unit connects to the shelf backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel which is then cabled to the cross-connect terminal.

At the cross-connect terminal, each unit connects to external apparatus by Tip and Ring leads.

Hardware installation

Table 1-1 provides cross connect information for the NT5K82HA Central Office trunk card.

Table 1-1
NT5K82HA Central Office Trunk connections

Lead	Pins	Pair color	Unit number
T0 R0	26 1	W-BL BL-W	Unit 0
PPM0 —	27 2	W-O O-W	
T1 R1	28 3	W-G G-W	Unit 1
PPM1 —	29 4	W-BR BR-W	
T2 R2	30 5	W-S S-W	Unit 2
PPM2 —	31 6	R-BL BL-R	
T3 R3	32 7	R-O O-R	Unit 3
PPM3 —	33 8	R-G G-R	
T4 R4	34 9	R-BR BR-R	Unit 4
PPM4 —	35 10	R-S S-R	
T5 R5	36 11	BK-BL BL-BK	Unit 5
PPM5 —	37 12	BK-O O-BK	
T6 R6	38 13	BK-G G-BK	Unit 6
PPM6 —	39 14	BK-BR BR-BK	
T7 R7	40 15	BK-S S-BK	Unit 7
PPM7 —	41 16	Y-BL BL-Y	

Trunk configuration

Route Data Block

Each trunk unit on the NT5K82HA Central Office trunk cards is attached to

a route with an associated route data block. Periodic Pulse Metering (PPM) and trunk timers are configured on a route basis.

The route data block is programmed in overlay 16, as described in Table 1-2.

Table 1-2
Overlay 16 Route Data Block—NT5K82HA

Prompt	Response	Comments
REQ	NEW	Define a new unit
TYPE	RDB	Define a new Route Data Block
CUST	0-99	Define customer number
ROUT	0-127	Define route number
TKTP	COT	Define trunk type as Central Office
ICOG	IAO	Incoming and Outgoing trunk
CNTR	YES	Change a trunk timer
TIMER	ICF 1920	Set Incoming Flash Timer
	OGF 512	Set Outgoing Timer
	EOD 4096	
	NRD 10112	Set No Ringing Detector
	ODT 4096	
	RGV640	Set Ring Validation Timer
	GTO 1024	Set Guard Timer Outgoing
	GTI 896	Set Guard Timer Incoming
CDR	YES	Call Detail Recording allowed
MR	PPM	Respond PPM for NT5K82HA
DTD	YES	Dial Tone Detection
XTDT	XX(see note)	Tone Detection Table Number
MDTD	05	Dial Tone Detection Delay
DTDF	00 00	Dial Detector Fail Threshold

Note:

Reference overlay 97 to set up the Dial Tone Detection .

TYPE DTD
XTDT xx
DFQ 03
MDL -20
BRK 00
CAD 00

SSC 00

Note:

Reference overlay 97 to set up make/break ratio for outpulsing.

TYPE SYSP
PPS10 67

Note:

Reference overlay 97 to set up DTMF dialing parameters.

TYPE XCTP
DTMF 191
INTU NO

Trunk Data Block

Use overlay 14 to configure each of the trunk units on the NT5K82HA Central Office trunk card, as described in Table 1-3. Default values are shown in brackets.

Table 1-3
Overlay 14 Trunk Data Block—NT5K82HA

Prompt	Response	Comments
REQ	NEW	Define a new unit
TYPE	COT	Central Office Trunk
TN	CC UU	Terminal number of the unit in Option 11 format: Card number, Unit number
XTRK†	XCOT	Type is IPE COT † Only required for the first unit to be defined for that pack.
CDEN	(8D)	Card Density is 8D (default)
SIGL	LOP	Loop Start Signaling
SEIZ	YES	Enable Autoguard Supervision
PPID	6	PPM ID
BTID	<cr>	Busy Tone ID not supported
CLS	XBTS	Busy Tone Supervision Disabled, Busy Tone Detection not supported
	DTN, (DIP)	Digitone (Digipulse) Signaling

Self-test

When the NT5K82HA is installed and power is applied to it, a self-test is performed on it. The red LED on the faceplate flashes three times, then remains continuously lit until the cards are enabled in software.

If the self-test fails, the LED will remain lit.

Technical description

Power requirements

Table 1-4 shows the power requirements for the NT5K82HA Central Office trunk card.

Table 1-4
NT5K82BA and NT5K82CA circuit card power requirements

Voltage	Idle current	Seize
+15.0 V dc	170ma	330 ma
-15.0V dc	170 ma	300 ma
+ 8.5 V dc	100 ma	100 ma
+ 5.0 V dc	200 ma	500 ma

Environmental specifications

Table 1-5 lists the environmental specifications of the NT5K82HA Central Office trunk cards.

Table 1-5
NT5K82HA circuit card environmental specifications

Parameter	Recommended Range	Absolute Range
Operating temperature	15 to 30 degrees C	0 to 45 degrees C
Operating humidity	20 to 55% Relative Humidity	20 to 80% Relative Humidity
Storage temperature	15 to 30 degrees C	-20 to 60 degrees C
Storage humidity	20 to 80% Relative Humidity	5 to 95% Relative Humidity

Transmission parameters

The NT5K82HA Belgian XCOT trunk was designed to meet the Belgian RTT CT/1 transmission specifications. The NT5K82HA supports both the New and the Old Belgian loss plans, when used with 8B software.

The New loss plan applies to Option 11 systems equipped with Intelligent Peripheral Equipment hardware only. The Old loss plan applies to systems

equipped with only Extended Peripheral Equipment hardware, and systems that use a combination of Extended Peripheral Equipment and Intelligent Peripheral Equipment hardware.

The loss plans are detailed below.

Old Belgian Loss Plan

	Long Line	Short Line
Analog-to-Digital loss	-2 dB	0 dB
Digital -to-Analog loss	-3 dB	-1 dB

Note:
The tolerance for the above nominal values is -0.3, +0.7 dB.

New Belgian Loss Plan

	Long Line	Short Line
Analog-to-Digital loss	-6 dB	-4 dB
Digital -to-Analog loss	1 dB	3 dB

Note:
The tolerance for the above nominal values is -0.3, +0.7 dB.

Trunk types description

The NT5K82HA Central Office Trunk card supports loop start signaling.

Loop start operation

Loop start operation is configured in software and is implemented in the card through software download messages.

Idle state

In the idle state, the ringing detector is connected across the tip and ring leads. The Central Office trunk card provides a high impedance loop toward the public exchange for isolation and dc detection.

Call placed by public exchange

The Central Office indicates an incoming call by applying ringing voltage between the tip and ring leads. If the call is answered, the ringing detector on the trunk card is switched out and a low resistance DC loop is placed between the tip and ring leads.

Call placed by Option 11

To initiate a call, the Option 11 switches out the ringing detector and places

a low resistance loop across the tip and ring leads. The Option 11 sends digits in the form of Dual Tone Multifrequency (DTMF) tones or loop disconnect pulses.

Call disconnect

The Option 11 controls the release of telephone calls. To indicate call disconnect, the Option 11 removes the dc loop across the tip and ring wires for longer than 700 ms. The ringing detector is then switched in and a high impedance loop is presented to the public exchange.

Periodic Pulse Metering (PPM)

The NT5K82HA Central Office Trunk card has an on-board 16 Hz PPM detector. Periodic Pulse Metering allows the user of a telephone on a Option 11 to keep an accurate record of public exchange calls for billing or administration purposes.

For more information on PPM, refer to *Generic X11 Including Supplementary Features appendix 2 to 553-2311-105.*

E&M Tie trunk circuit card

Functional description

The NT5K83HA E&M Tie trunk card provides the interface between the Option 11 system and up to four analog trunks. It can be installed in slots 1 to 10 in the main cabinet and in any slot in the expansion cabinet.

The NT5K83HA E&M Tie trunk card supports four analog trunks. Each trunk circuit can be individually configured as:

- 2 and 4-wire E&M Transmission
- Type I, Type II and Type V E&M signaling
- Recorded Announcement trunk (RAN)
- Voice Paging Trunk features
- AC15

The card supports these features on a per unit basis.

Common features

The NT5K83HA E&M Tie trunk card:

- provides Analog-to-Digital and Digital-to-Analog conversion for 4 audio paths.
- allows trunk type to be configured on a per channel basis
- provides software selectable A/μ Law operation
- indicates self-test status with faceplate LED
- provides for disabling of individual units or the entire board under software or XPEC control
- provides outpulsing on the card; the make break ratios will be software downloadable in the initial configuration stage
- provides loopback of Pulse Code Modulation (PCM) signals to DS30X for testing and diagnostic purposes
- provides termination against 600 ohms for 4-wire E&M trunk circuits
- provides termination and transhybrid balance matching against 600 ohms for 2-wire E&M trunk circuits
- provides an AC15 interface
- provides a PAG (Voice Paging) interface
- provides a RAN (Recorded Announcement/Music) interface

- provides a Radio Paging interface
- provides flexible transmission for various loss plans
- interfaces each of the 4 PCM digital signals to one DS30X channel in A10 format
- send transmit and receive SSD signaling messages over a DS30X signaling channel in A10 format

Physical description

Switch settings

Switch settings for NT5K83HA are described in Table 2-1. Four switch settings, 1 per unit, are used to select Type V E&M signaling. Type I and II are configured in software.

Table 2-1
NT5K83HA Switch Settings

Signaling	J1.x Pins 1-2	J1.x Pins 2-3
4 Wire Type II	Closed	Open
4 Wire Type I	Closed	Open
2 Wire Type I	Closed	Open
AC15	Closed	Open
RAN	Closed	Open
MUS	Closed	Open
PAG	Closed	Open
4 Wire Type V (BPO)	Open	Closed
2 Wire Type V (BPO)	Open	Closed

Connections

The NT5K83HA trunk card has four units. Each unit connects to the shelf backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel which is then cabled to the cross-connect terminal.

Tables 2-2 to 2-5 show cross connect terminations for the NT5K83HA E&M trunk card.

Table 2-2
NT5K83HA E&M 2-Wire Paging trunk connections

Lead designations	Pins	Pair color	Unit number
T0 R0	27 2	W-O O-W	Unit 0
A PG	29 4	W-BR BR-W	
T1 R1	31 6	R-BL BL-R	Unit 1
A PG	33 8	R-G G-R	
T2 R2	35 10	R-S S-R	Unit 2
A PG	37 12	BK-O O-BK	
T3 R3	39 14	BK-BR BR-BK	Unit 3
A PG	41 16	Y-BL BL-Y	

Table 2-3
NT5K83HA E&M 2-wire Recorded Announcement trunk connections

Lead designations	Pins	Pair color	Unit number
T0 R0	26 1	W-BL BL-W	Unit 0
SIG B SIG A	29 4	W-BR BR-W	
T1 R1	30 5	W-S S-W	Unit 1
SIG B SIG A	33 8	R-G G-R	
T2 R2	34 9	R-BR BR-R	Unit 2
SIG B SIG A	37 12	BK-O O-BK	
T3 R3	38 13	BK-G G-BK	Unit 3
SIG B SIG A	41 16	Y-BL BL-Y	

Table 2-4
NT5K83HA E&M 4-Wire Type 1 connections

Lead designations	Pins	Pair color	Unit number
RA RB	26 1	W-BL BL-W	Unit 0
TA TB	27 2	W-O O-W	
E M	28 3	W-G G-W	
RA RB	30 5	W-S S-W	Unit 1
TA TB	31 6	R-BL BL-R	
E M	32 7	R-O O-R	
RA RB	34 9	R-BR BR-R	Unit 2
TA TB	35 10	R-S S-R	
E M	36 11	BK-BL BL-BK	
RA RB	38 13	BK-G G-BK	Unit 3
TA TB	39 14	BK-BR BR-BK	
E M	40 15	BK-S S-BK	

Note: The cable pair designated TA, TB is the transmit pair. The pair designated RA, RB is the receive pair.

Table 2-5
NT5K83HA E&M 4-Wire Type 2 trunk connections

Lead designations	Pins	Pair color	Unit number
RA RB	26 1	W-BL BL-W	Unit 0
TA TB	27 2	W-O O-W	
E1/E2 M!/M2	28 / 3 29 / 4	W-G / G-W W-BR / BR-W	
RA RB	30 5	W-S S-W	Unit 1
TA TB	31 6	R-BL BL-R	
E1/E2 M!/M2	32 / 7 33 / 8	R-O / O-R R-G / G-R	
RA RB	34 9	R-BR BR-R	Unit 2
TA TB	35 10	R-S S-R	
E1/E2 M!/M2	36 / 11 37 / 12	BK-BL / BL-BK BK-O / O-BK	
RA RB	38 13	BK-G G-BK	Unit 3
TA TB	39 14	BK-BR BR-BK	
E1/E2 M!/M2	40 / 15 41 / 16	BK-S / S-BK Y-BL / BL-Y	

Note: The cable pair designated TA, TB is the transmit pair. The pair designated RA, RB is the receive pair.

Self-test

When the NT5K83HA trunk card is installed and power is applied to it, a self-test is performed on the card. The red faceplate LED on flashes three times, then remains continuously lit until the card is enabled in software.

If the self-test fails, the LED will remain lit after the card is enabled.

Trunk configuration

Route Data Block

Each trunk unit on the NT5K83HA E&M trunk card is attached to a route with an associated route data block. The route data block is programmed in overlay 16.

Note:
All prompts are defaulted except for those noted in Table 2-6. Default values are shown in brackets.

Table 2-6
LD 16 Route Data Block

Prompt	Response	Comments
REQ	NEW	
TYPE	RDB	Define a new Route Data Block
CUST	0-99	Enter customer number
ROUT	0-511	Enter route number
TKTP	TIE, RAN, PAG	Define trunk type as Tie, Recorded announcement or Paging
ICOG	IAO	Incoming and Outgoing trunk
ACOD	XX	XX=Trunk route access code

Trunk Data Block

Use overlay 14 to configure each of the trunk units on the NT5K83HA E&M trunk card. Default values are shown in brackets.

Table 2-7
LD 14 Route Data Block

Prompt	Response	Comments
REQ	NEW	Define a new trunk unit
TYPE	TIE, RAN, PAG	Trunk type Tie, (Recorded announcement), (Voice paging)
TN	CC UU	Terminal number of the unit: Card, Unit
XTRK (see note)	XFEM	Type is IPE XFEM
SIGL	EM4, EAM, WR4	4 wire E&M, 2-wire E&M, CEPT L1 AC15 signaling
EMTY	TY1, (TY2)	Type 1 signaling, (Type 2)
STRI	IMM, WNK, DDL	Incoming start Immediate, Wink, Delayed dial
STRO	IMM, WNK, DDL	Outgoing start immediate, Wink, Delayed Dial
SUPN	YES, (NO)	Answer and disconnect supervision
CLS	DTN, (DIP)	Digitone, (Dialpulse)

Note:
This prompt is required only for the first unit defined on each NT5K83HA card.

Technical description

Power requirements

Table 2-8 lists the power requirements for the NT5K83HA trunk card.

Table 2-8
NT5K83HA Power requirements

Voltage	Maximum current
+15.0 V dc	150 ma
- 15 V dc	150 ma
+8.5 V dc	35 ma
+ 5 V dc	110 ma
-48 V dc	80 ma

Environmental specifications

Table 2-9 provides the environmental specifications for the NT5K83HA E&M Tie trunk card.

Table 2-9
NT5K83HA Environmental specifications

Parameter	Absolute Limit
Operating temperature	10-45 degrees C, ambient
Operating humidity	20 to 80% RH (non condensing)
Storage temperature	-20 to +60 degrees C

Transmission parameters

The NT5K83HA E&M trunk card supports both the New and the Old Belgian loss plans, when used with 8B software.

The New loss plan applies to Option 11 systems equipped with Intelligent Peripheral Equipment hardware only. The Old loss plan applies to systems equipped with only Extended Peripheral Equipment hardware, and systems that use a combination of Extended Peripheral Equipment and Intelligent Peripheral Equipment hardware.

The loss plans are detailed below.

Old Belgian Loss Plan

Analog-to-Digital loss	0 dB
Digital -to-Analog loss	3 dB

Note:

The tolerance for the above nominal values is +/-0.5 dB.

New Belgian Loss Plan

Analog-to-Digital loss	-3.5 dB
Digital -to-Analog loss	3.5 dB

Note:

The tolerance for the above nominal values is +/-0.5 dB.

Trunk types description

Each unit on the NT5K83HA E&M trunk card supports:

- 2-wire E&M trunk type
- 4-wire E&M trunk type
- Recorded Announcement (RAN) trunk
- Paging (PAG) trunk
- 2280 Hz Tie Trunk (AC15)

E&M Signalling Requirements

The NT5K83HA will support the E&M Type I, Type II and Type V (also know as BPO) methods of signaling. Types I and V use two signaling wires which are electrically separated from the associated speech circuit. These two signaling wires are designated E and M (Ear and Mouth). Signals are sent on the M wire and received on the E wire. Earth is used for the signal return path.

Type II uses two signaling pairs for the E and the M signals. This allows an actual signal return lead instead of using earth return as the other signaling methods do.

Signalling Conditions

The following signaling conditions apply to the NT5K83HA E&M trunk card:

1 The signaling system will not apply any DC potentials in excess of -60 volts and +3 volts to either the E or the M wires.

2 The signaling system will not cause any currents greater than 25mA to flow in either the E or the M wire.

3 The signaling system will meet requirements in the presence of an earth potential difference of +3 volts between the sending and the receiving equipment.

4 DC potentials are relative to earth at the PBX that is applying the signal.

.Signalling States

The various signaling states that apply to the NT5K83HA E&M trunk card are described below.

Sending Type I signals

Signals are sent as either EARTH-ON or BATTERY-ON and apply to the M wire as follows:

EARTH-ON:earth is applied to the M wire

BATTERY-ON :-48V is applied to the M-wire

Safety current limiting is applied by the use of PTC's in each signaling condition.

Sending Type V signals

Signals are sent as either EARTH-ON or EARTH-OFF and apply to the M wire as follows:

EARTH-ON:earth is applied to the M wire

EARTH-OFF:removal of EARTH-ON condition

Under both EARTH-ON and EARTH-OFF conditions an earthed 1uF capacitor shall be applied to the M wire.

Sending Type II signals

Signals are sent as either OPEN or CLOSED and apply to the M wire pair.

Receiving Type I and V signals

Electrical conditions applied to the E wire are either EARTH-ON or

EARTH-OFF as follows:

EARTH-ONAn earth via a resistance of up to 1500 ohms in parallel with a capacitor of 1uF applied to the E wire shall be accepted as EARTH-ON an condition

EARTH-OFFAn earth via a resistance of greater than 20 Kohms in parallel with a capacitor of 1uF applied to the E wire shall be accepted as an EARTH-OFF condition.

The recognition of EARTH-ON and EARTH-OFF signals are not affected by the presence, on the E wire, of a potential between -60V to +3V with a resistance of at least 150 Kohms.

Receiving Type II signals

Electrical conditions applied to the E wire are either OPEN or CLOSED as follows:

OPEN: A resistance of greater than 20 Kohms applied to the E wire pair shall be accepted as an OPEN condition.

CLOSED:A resistance of up to 2 Kohms applied across the E wirepairshall be accepted as CLOSED condition

The recognition of EARTH-ON and EARTH-OFF signals are not affected by the presence, on the E wire, of a potential between -60V to +3V with a resistance of at least 150 Kohms.

Signalling codes

When a call is being processed, a number of signaling codes are sent on the M wire and received on the E wire. These codes have specified meaning to the Option 11, and are explained below.

Idle

In the idle state the Option 11 applies an "Idle Signal" to the M wire to indicate it is free to accept incoming calls.

Seizing

When a circuit is selected by for an outgoing call, the Option 11 applies a seizing signal to the associated M wire. On recognition of the "Seizing signal", the far end switch busies the circuit against outgoing calls and prepares to receive the routing information.

Holding

The continued receipt of the seizing signal is accepted by the far end switch as a "Hold Signal".

Dialing

Digits are sent through the near end M lead in the form of 10 pps pulses.

Answer

When the called party answers, the far end sends an “answer” signal through the M lead.

Clear Down

Either party can disconnect the call by applying a clear signal to the M lead. The far end applies a “clear back” signal, while the near end applies a “clear forward” signal. The circuit remains busy until both clear forward and clear backward signals have been exchanged.

The signaling codes for Types I, II and V are listed in Tables 2-10, 2-11 and 2-12 respectively. The signal sending durations are continuous unless otherwise specified. Only signals with durations given in these tables will be sent.

Table 2-10

Summary of NT5K83HA Type I signaling states

Signal	Option 11 sending condition - M wire	Option 11 receiving condition - E wire
Idle	Earth On	Earth Off
Seizing	Battery On	Earth On
Hold	Continuation of Seizing Signal	Continuation of Earth On condition
Digit Pulse	Earth On pulses in step with dial pulses	-
Answer	Battery On	Earth On
Clear For-ward	Earth On for longer than 300mS	-
Clear Back	-	Earth Off for longer than 300mS

Table 2-11
Summary of NT5K83HA Type II signaling states

Signal	Option 11 sending condition - M wire	Option 11 receiving condition - E wire
Idle	OPEN	OPEN
Seizing	CLOSED	-
Hold	Continuation of Seizing Signal	-
Digit Pulse	OPEN pulses in step with dial pulses	-
Answer	Closed	CLOSED
Clear For-ward	OPEN for longer than 300mS	-
Clear Back	-	OPEN for longer than 300mS

Table 2-12
Summary of NT5K83HA Type V signaling states

Signal	Option 11 sending condition - M wire	Option 11 receiving condition - E wire
Idle	Earth Off	Earth Off
Seizing	Earth On	-
Hold	Continuation of Seizing Signal	-
Digit Pulse	Earth Off pulses in step with dial pulses	-
Answer	-	Earth On
Clear Forward	Earth Off for longer than 300mS	-
Clear Back	-	Earth Off for longer than 300mS

Recorded Announcement/Music trunk operation

When used in the Recorded Announcement/Music mode, the trunk circuit is connected to a customer provided recorded announcement machine or a music source.

The following machines can be used with the NT5K83HA E&M card:

- Cook Digital 4 Channel Announcer
- Audichron HQI-112

Paging trunk operation

When used in the paging mode, the trunk circuit is connected to a customer-provided paging amplifier system. When accessed, the card provides a loop closure. In a typical application, the loop closure will cut off a music supply and switch the paging trunk transmission path to the paging amplifier.

Direct Dial Inward trunk circuit card

Functional description

The NT5K84HA Direct Dial Inward (DDI) trunk card provides the interface between the Option 11 system and up to eight analog DDI trunk lines. It can be installed in slots 1 to 10 in the main cabinet and in any slot in the expansion cabinet.

The NT5K84HA supports the Belgian Direct Inward Dialing Signaling protocol.

Common features

Each NT5K84HA DDI Trunk card:

- provides analog-to-digital and digital-to-analog conversion for 8 audio paths
- uses software selectable A/U Law operation
- indicates self-test status with faceplate LED
- provides for disabling of individual units or the entire board under software or XPEC control
- provides loopback of Pulse Code Modulation (PCM) signals to DS30X for testing and diagnostic purposes
- provides termination impedance to match Belgian complex impedance Z1
- provides transhybrid Balance matching against Belgian complex impedance Z1
- provides for loss pads (analog-to-digital and digital-to-analog) as per the Belgian loss plan and call path set-up
- meets the Belgian Loss Plan and provide a base for future loss plan change by use of the B34 Codec with software selectable loss pads (phase 8B software)
- corrects signaling impedances to operate with the Belgian Central Office
- will support Multifrequency Compelled (MFC) signaling when used with the NT5K21 XMFC Sender/Receiver Pack

Physical description

Connections

The NT5K84HA DDI trunk card has eight units. Each trunk unit on the card connects to the backplane through an 80-pin connector. The backplane is ca-

bled to the input/output (I/O) panel, and the I/O panel is cabled to the cross-connect terminal.

Hardware installation

Table 3-1 provides cross connect information for the NT5K84HA DDI trunk card.

Table 3-1
NT5K84HA DDI cross connect terminations

Pair	Pins	Pair color	Unit number
T0	26	W-BL	
R0	1	BL-W	Unit 0
	27	W-O	
	2	O-W	
T1	28	W-G	
R1	3	G-W	Unit 1
	29	W-BR	
	4	BR-W	
T2	30	W-S	
R2	5	S-W	Unit 2
	31	R-BL	
	6	BL-R	
T3	32	R-O	
R3	7	O-R	Unit 3
	33	R-G	
	8	G-R	
T4	34	R-BR	
R4	9	BR-R	Unit 4
	35	R-S	
	10	S-R	
T5	36	BK-BL	
R5	11	BL-BK	Unit 5
	37	BK-O	
	12	O-BK	
T6	38	BK-G	
R6	13	G-BK	Unit 6
	39	BK-BR	
	14	BR-BK	
T7	40	BK-S	
R7	15	S-BK	Unit 7
	41	Y-BL	
	16	BL-Y	

Self-test

When the card is installed, the red Light Emitting Diode (LED) on the face-plate flashes as the self-test runs. If the self-test completes successfully, the card is automatically enabled (if it has been configured in software) and the LED goes out. If the self-test fails, the LED will remain lit. The LED will also remain lit if one or more units on the card become disabled while the card is operating.

Trunk configuration

Route Data Block

Each trunk unit on the NT5K84HA DDI trunk card is attached to a route with an associated route data bloc route data block is configured in LD 16.

Note:

All prompts are defaulted except for those noted in Table 3-2.

Table 3-2
LD 16 Route Data Block—NT5K84HA

Prompt	Response	Comments
REQ	NEW	Define a new unit
TYPE	RDB	Define a new Route Data Block
CUST	0-99	Define customer number
ROUT	0-127	Define route number
TKTP	DID	Define trunk type as DID
ICOG	ICT	Incoming only trunk
MFC	R2MF	Multifrequency compelled signaling
MFCI	XX	MFC Incoming table number
CNTR	YES	Change a trunk timer
TIMER	ICF 0 GTI 128 MFC 64896 DSI 59904	Set Incoming Flash Timer to 0 Set Guard Timer Incoming to 128 ms
NEDC	ETH	Near End Disonnect Control
FEDC	ETH	Far End Disonnect Control
CDR	NO	Call Detail Recording

Note:

Reference overlay 97 to configure MFC receiver level.

```
TYPE   SYSP
MFRL   0
```

Trunk Data Block

Use overlay 14 to configure each of the trunk units on the NT5K84HA DDI trunk card. Default values are shown in brackets in Table 3-3.

Table 3-3
LD 14 Trunk Data Block—NT5K84HA

Prompt	Response	Comments
REQ	NEW	Define a new trunk unit
TYPE	DID	Type is Direct Inward Dial
TN	CC UU	Terminal number of the unit: Card, Unit
XTRK	XDID	Type is IPE DID
SIGL	EAM	Loop Dial Repeating signaling
STRI	IMM	Incoming start is immediate dial
CLS	DTN, (DIP), MFC	Digitone (Digipulse) Signaling
MFL	0	Multifrequency digit level
MFPD	NO	Multifrequency PAD

Use overlay 94 to configure MFC table, as described in Table 3-4.

Table 3-4
LD 94 Multifrequency Signaling—NT5K84HA

Prompt	Response	Comments
TYPE	R2MF	R2 MFC data block
ICOG	ICT	Incoming table
EECD	1	End-to-end signaling code
SMFC	NO	Send MFC
SCNT	NO	Switch CNI on Next
LVNO	1	Level number
RECV	Digits 1 - 9, 0	Receive signal number
XMIT	NEXT 1 TERM 6 COMP 6	Transmit signal mnemonic and number

Use overlay 56 to configure tones, as described in Table 3-5.

Table 3-5
LD 56 Flexible Tones and Cadences—NT5K84HA

Prompt	Response	Comments
TYPE	FTC	Flexible Tones and Cadences data block
DIAL	XTON 208 XCAD 000	Dial Tone
SPCL	XTON 208 XCAD 000	Special Dial Tone
BUSY	XTON 208 XCAD 005	Busy Tone
RGBK	XTON 208 XCAD xxx See note 1 below	Ringback Tone
OVFL	XTON 208 XCAD 017	Overflow Tone
INTU	XTON 111 XCAD yyy CDNC 000 See note 2 below	Intrusion Tone

Note 1:

For the RGBK prompt response for XCAD, enter the following responses in LD 56

```
TYPE  FCAD
WCAD  xxx
CDNC  205 614 000 000
END   REPT
CYCS  1
WTON  NO
```

Note 2:

For the INTU prompt response for XCAD, enter the following responses in LD 56

```
WCAD  yyy
CDNC  20 300 000 000
END   REPT
CYCS  1
WTON  NO
```

Technical description

The technical details of the NT5K84HA Direct Dialing Inward trunk card are outlined below.

Power requirements

Table 3-6 lists the power requirements for the NT5K84HA DDI trunk card.

Table 3-6
NT5K84HA power requirements

Voltage	Idle current	Active current	Disabled current
+15.0 V dc	67 ma	162 ma	67 ma
-15 V dc	212 ma	212 ma	125 ma
+8.5 V dc	80 ma	80 ma	77 ma
+ 5.0 V dc	218 ma	249 ma	105 ma

Environmental specifications

Table 3-6 lists the environmental specifications for the NT5K84HA DDI card.

Table 3-7
NT5K82HA circuit card environmental specifications

Parameter	Recommended Range	Absolute Range
Operating temperature	15 to 30 degrees C	0 to 45 degrees C
Operating humidity	20 to 55% Relative Humidity	20 to 80% Relative Humidity
Storage temperature	15 to 30 degrees C	-20 to 60 degrees C
Storage humidity	20 to 80% Relative Humidity	5 to 95% Relative Humidity

Transmission parameters

The NT5K82HA supports both the New and the Old Belgian loss plans, when used with 8B software.

The New loss plan applies to Option 11 systems equipped with Intelligent Peripheral Equipment hardware only. The Old loss plan applies to systems equipped with only Extended Peripheral Equipment hardware, and systems that use a combination of Extended Peripheral Equipment and Intelligent Peripheral Equipment hardware.

The loss plans are detailed below.

Old Belgian Loss Plan

	Long Line	Short Line
Analog-to-Digital loss	-2 dB	0 dB
Digital -to-Analog loss	-3 dB	-1 dB

Note:
The tolerance for the above nominal values is -0.3, +0.7 dB.

New Belgian Loss Plan

	Long Line	Short Line
Analog-to-Digital loss	-6 dB	-4 dB
Digital -to-Analog loss	1 dB	3 dB

Note:
The tolerance for the above nominal values is -0.3, +0.7 dB.

Direct Dialling Inward description

Each unit on the NT5K84HA DDI card operates as a DDI trunk. Table 3-7 presents a summary of NT5K84HA DDI trunk card signaling states.

Idle State

In the idle state the CO applies -48V on the tip wire, and Ground on the ring wire. With K1 closed, the DID termination provides a short circuit through D31.

Seize

The line is seized when the CO reverses battery (applying Ground on the tip wire, and -48V on the ring wire). A message is sent to the Central Processing Unit (CPU), and the microprocessor prepares for receipt of dialing digits. K1 is energized while K2 is non - energized.

The DID will not recognize the seizure if applied for less than 100ms.

Seize Acknowledge signal

When the DID recognizes a valid seize, it sends back a seizure acknowledge signal from firmware, in response to the proceed to send message. The CO then knows that the DID is ready to receive dialing information. K1 is energized and K2 is energized.

MFC Signaling

The signaling information is MFC (multifrequency compelled), between the CO and the NT5K21 XMFC sender/receiver pack. The speech capacitor across tip and ring wires presents a low impedance to AC signals.

Answer Signal

After the called party answers, the DID sends an answer signal to the CO by de-energizing K1 and K2, causing the tip to ring resistance to drop to 500Ω.

Clear Back Signal (near end release)

When the Option 11 disconnects the call, the CPU sends a message to the DDI unit. The DID unit increases the loop resistance to 15.5KΩ by energizing K1 and K2. This signals a Clear Back request to the CO.

Clear Forward after Clear Back

After receiving the Clear Back signal, the CO sends a Clear Forward signal by reversing battery back to the idle state. The tip to ring connection then becomes an open circuit. The DID detects that current is no longer flowing and sends a release message if the condition lasts for more than 100ms.

Clear Forward acknowledge

After receiving the release message, the DID unit energizes K1, returning to the idle condition.

Clear Back Signal (far end release)

When the far end disconnects first, the CO reverses battery to the idle condition. The CO now sees zero current through the XDID. Software responds by energizing K1.

Blocking Signal

The DID termination informs the CO that it is unable to accept call by presenting an open circuit condition. Blocking can only occur from the idle condition, the DID unit cannot enter blocking from any other state.

Table 3-7
Summary of NT5K84HA DDI Trunk card signaling states

Signal	Direction	Central Office State	Option 11 State
Idle	-	Battery	Short Circuit thru D31 (K1 closed)
Seize	CO to M1	Battery Reversed	500Ω (K1 closed)
Proceed to Send	M1 to CO	Battery Reversed	15.5kΩ (K2 open)
MFC Signals	R2 both directions	Battery Reversed	15.5kΩ (K2 open)
Answer	M1 to CO	Battery Reversed	500Ω (K1 closed)
CO Disconnects first:			
Clear Forward	CO to M1	Battery	Short Circuit thru D1 (K1 closed)
M1 Disconnects first:			
Clear Back	M1 to CO	Battery Reversed	15.5kΩ (K1 energized, K2 energized)
Clear Forward	CO to M1	Battery	Open Circuit (K1 open)
Clear Fwd Ack	M1 to CO	Battery	Short Circuit thru D31 (K1 energized, K2 de-energized)

Flexible analog line circuit card

Functional description

The NT5K96HA Flexible analog line card provides an interface for up to 16 analog (500/2500-type) telephones lines. It can be installed in slots 1 to 10 in the main cabinet and in any slot in the expansion cabinet.

Common features

The NT5K96HA Flexible Analog line card provides the following features:

- provides analog-to-digital and digital-to-analog conversion for 16 audio phone lines
- interfaces each of the 16 digital (PCM) signals to one DS30X timeslot
- transmits and receives SSD signaling messages over a DS30X signaling channel
- provides current drive with a balanced three component complex termination
- provides ON HOOK/OFF HOOK detection.
- provides for connection of an AC ringing signal and automatic disconnection when the station set goes offhook
- synchronizes connection and disconnection of ringing signal
- provides for loopback of SSD messages for diagnostic purposes
- provides indication of board status with faceplate mounted LED.
- provides correct initialization of all features at power up.
- provides line current to telset which is to be limited on short loops, and under fault conditions; otherwise the loop current will vary with loop length to allow automatic gain compensation to operate in the telset
- supports A-Law operation only
- provides software downloadable loss plan with phase 8B or later software
- provides loopback of Pulse Code Modulation (PCM) signals to DS30X for testing and diagnostic purposes
- provides card self ID for auto configuration
- provides direct reporting of digits dialed (500 sets) by collecting dial pulses (10 and 20 pps)

Physical description

Switch settings

There are no option switches on the Flexible Analog line card. All settings are configured in software.

Connections

The Flexible Analog line card has 16 units. Each unit connects to the shelf backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel which is then cabled to the cross-connect terminal. At the cross-connect terminal, each unit connects to external apparatus by tip and ring leads.

Faceplate LED

The faceplate of the NT5K96HA is equipped with a red LED which lights when all of the assigned units on the circuit card are disabled.

Technical description

Power requirements

Table 4-1 lists the power requirements for the NT5K96HA Flexible Analog line card. The Active Current is the individual current for each active line. Loop current varies from 20 to 45 ma depending on loop length.

Table 4-1
NT5K96HA Flexible Analog line card power requirements

Voltage	Tolerance (+/-)	Idle current	Active current	Maximum current (all units active)
+15.0 V dc	0.05 V dc	120 ma	0 ma	120 ma
-15.0 V dc	0.05 V dc	48 ma	0 ma	48 ma
+ 8.5 V dc	1.0 V dc	250 ma	8 ma	280 ma
-48.0 V	2.40V dc	60 ma	40 ma	700 ma
- 48.0 V dc	2.40 V dc	0 ma	10 ma (see note 1)	160 ma
-120.0 V dc	5.0 V dc	0 ma	1 ma	32 ma
Ring V ac	5.0 V dc	0 ma	10 ma (see note 2)	160 ma (see note 2)

Note 1:
Each active ringing relay requires 10 mA of battery.

Note 2:
This figure reflects the current for ringing a single station set. There may be as many as 5 ringers on each line.

Environmental specifications

Table 4-2 lists the environmental specifications of the Flexible Analog line card.

Table 4-2
NT5K96HA Flexible Analog line card environmental specifications

Parameter	Specifications
Operating temperature	0 to 50 degrees C, ambient
Operating humidity	10 to 95 % Relative Humidity

Signalling

Loop operation

The Flexible Analog Line Card is loop start, with a loop limit of 1000 Ω at -48 V excluding the telephone set. The minimum and maximum values of current feed are 18 to 50 ma respectively. A resistance of more than 10 kohm is recognized as an idle or release signal.

Table 4-3 lists the number of telephone sets that can be supported by the loop.

Table 4-3
Loop limits

Loop resistance including telephone sets	Number of telephone sets
350 Ω or less	2
Over 350 Ω to a maximum of 1200 Ω	1

Ringers

Ringing is supplied to the telephones at a frequency of 25 to 50 Hz.

The Flexible Analog Line Card supports any number of ringers up to a maximum ac impedance presented to the line of 350 ohms. Table 4-4 shows the number of ringers supported for various loop lengths.

Table 4-4
Ringers supported on each unit of the NT5K96HA card

Number of Ringers	1	2	3	4	5
Loop Length (Ω)	1000	1000	850	600	350

Digipulse dialing

The ratio between the duration of a loopbreak and the duration of a complete pulse (opening + closing) must lie between 0.63 and 0.70.

The interval between two digits must be at least 400 ms.

Digitone dialing

Dual Tone Multifrequency (DTMF) tones are routed to the NT5K48 tone de-

tector card.

On-Hook/Off-Hook Detection

Opening of the set power supply loop for more than 400ms is recognized as an on-hook signal.

Hookflash Requirements

Signaling with the service button is accomplished either by opening the line or by injecting a high resistance (more than 17kOhm) for a timed interval of between 95 ms and 155ms.

Ground Recall Detection (Register Recall)

The use of an earth for line signaling by means of the service button is not allowed for remote push button sets and is not supported by the NT5K96HA.

Transmission parameters

The NT5K96HA Flexible Analog Line card supports both the New and the Old Belgian loss plans.

The New loss plan applies to Option 11 systems equipped with Intelligent Peripheral Equipment hardware only. The Old loss plan applies to systems equipped with only Extended Peripheral Equipment hardware, and systems that use a combination of Extended Peripheral Equipment and Intelligent Peripheral Equipment hardware.

The loss plans are detailed below.

Old Belgian Loss Plan

Analog-to-Digital loss	4 dB
Digital -to-Analog loss	3 dB

Note:

The tolerance for the above nominal values is -0.3, +0.7 dB.

New Belgian Loss Plan

Analog-to-Digital loss	0 dB
Digital -to-Analog loss	7 dB

Note:

The tolerance for the above nominal values is -0.3, +0.7 dB.

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Meridian 1

Intelligent peripheral equipment cards for Belgium

Option 11—Description and installation

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